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(Bulletins 285 to 295 constitute the Report for 1920. In binding, pages i-xii at the end of this bulletin should be detached and placed before Bulletin 285 which begins with page 1.)

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Maine Agricultural Experiment Station

ORONO

BULLETIN 295 **DECEMBER, 1920**

ABSTRACTS OF PAPERS NOT INCLUDED IN BULLETINS, FINANCES, METEOROLOGY, INDEX.

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MAINE

AGRICULTURAL EXPERIMENT STATION

ORONO, MAINE

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BULLETIN 295

ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1920 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1920 is given on pages x to xi of the introduction to this Report. The following pages contain abstracts of the papers issued during the year that are not included in the Bulletins or Official Inspections for the year.

INHERITANCE IN CROSSES OF DAIRY AND BEEF BREEDS OF CATTLE.

II. On the Transmission of Milk Yield to the First Generation.*

The purpose of this paper is to give briefly the facts discovered on the inheritance of milk yield by the use of the crossbred herd.

If the substance of these pages is recapitulated it is found that Crossbred No. 1 resembles her low producing parent 7.7 times as closely as she does the high producing parent. The other eleven crossbreds resemble the high producing line of milk production from 1.5 to 18.0 times as closely as they do the low line of milk production. If this paralleling of the high line production is averaged it is found that they resemble the high line of production 4.76 times as closely as they do the low line. These facts argue for the transmission of milk production by factors which show partial dominance. It would not seem that they argued for increased vigor of heterosis only, because of the case of Crossbred No. 1, where the low line milk yield was definitely transmitted instead of the high yield. In fact it would appear that this Crossbred is more likely to be a segregate of low milking factors from the high milking factors carried by her dam.

---

*This is an abstract from a paper by John W. Gowen having the same title and published in the Journal of Heredity, Vol. XI, No. 10.

Three levels of milk production are crossed in these experiments. The Aberdeen Angus cattle constitute the lowest level, the Jersey, Guernsey and Ayrshire cattle averaging about the same in milk yield constitute the intermediate level of production and the Holstein-Friesian cattle having the highest yield represent the highest level of production. It is of some interest to compare the results of crossing the different levels. If we omit the result of Crossbred No. 1 it is found that the Holstein-Friesian cows or bulls mated to the second group of cows or bulls (Jersey, Guernsey or Ayrshire) produced offspring who are 8.43 times as near the milk production of the high level on the average as they were the low line of production.

The only cross involving the Holstein-Friesian and Aberdeen Angus, Crossbred No. 44, was 2.2 times as close to the high line of production as she was close to the low line of her parent's milk yield.

It is of interest to note in this connection that Crossbred No. 44's milk yield resembles closely the milk yield of the intermediate group (Jersey, Guernsey and Ayrshire) of these experiments.

The crosses involving the second level of milk production (Jersey, Guernsey and Ayrshire) mated to the third group Aberdeen Angus, had crossbred offspring resembling the high line 7.7 times as closely as they did the low line of production. This figure compares favorably with that of the Holstein-Friesian x Jersey crosses.

If the crosses are compared to determine what effect the high line on the sire's side of the cross may have in comparison with the effect produced by the high line being on the dam's side of the cross it is found that the results in the three lines are contradictory. When the Holstein-Friesian sires were mated to second class dams, Guernseys, the offspring resembled the high line 11.3 times as closely as she did the low line. When the Jersey sire, second class, was mated to the Holstein-Friesian cows, highest class, the milk production of the offspring, once resembled the high class 2.7 to 1 and once the low line 7.7 to 1. The crosses involving the highest milk line, Holstein-Friesian bull, to the lowest milking line Aberdeen Angus cow produced an offspring resembling the high line 2.2 times as closely as the low line. The crosses of the second level in milk production to the third level show that when the higher level is on the sire's side the daughters resembled the high line 3.6 times as closely as they did the low line. When this higher level is on the dam's side the daughters resembled the high line 9.34 times as closely as they did the low line. It seems doubtful from these results if there are modifying sex linked factors present.

INHERITANCE IN CROSSES OF DAIRY AND BEEF BREEDS OF CATTLE.

III. TRANSMISSION OF BUTTER-FAT PERCENTAGE IN THE FIRST GENERATION.*

This paper presents the facts on the inheritance of butter-fat percentage as discovered by the analysis of the data accumulated in the cross breeding experiment. Twelve crosses were analyzed in this work.

These observations may be regrouped to show the changes brought about in the butter-fat percentage of the offspring in accordance with the way the cross was made. For those crosses in which Holstein-Friesian sire was used the offspring in all cases resembled the low testing sire between 3.3 and 4.5 to 1 as closely as they did the high testing parent, the mean being 3.9 to 1. For those crosses in which the dam was of the Holstein-Friesian breed the results of the offspring were contradictory one approaching the butter-fat percentage of the high test parent 1.4 to 1 and the other approaching the butter-fat test of the low Holstein-Friesian cow 7.3 to 1. The cross involving the Ayrshire dam resembled the low test 2.6 to 1. The high test Guernsey dam when crossed to the lower test Aberdeen Angus sire had a daughter which resembled the low testing sire 5.5 times as closely as she did the high testing dam.

Considering every cross irrespective of their merit for this particular phase of the work the crosses resemble the low testing parental breed 2.23 times as closely as they do the high testing parental breed.

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*This is an abstract from a paper by John W. Gowen having the same title and published in Journal of Heredity, Vol. XI, No. 12.

It is of interest to examine the results of these experiments on butter-fat percentage in the light of those for milk yield. It will be remembered that in the F_1 crossbreds milk yield was intermediate between that of the high and low parents but approached most nearly that of the high parent. In the genetics of many economic characters as yield of grain, size of the animal etc. the explanation used to account for such a phenomena is the heterozygous nature of the factors contained in the F_1 animal as compared to the homozygous nature of the factors in the parental breeds or strains. Without question there may be something to this hypothesis for certain crosses. The results for milk yield and butter-fat percentage do present a paradoxical position when this hypothesis is applied to them. Thus milk yield is increased over what the true intermediate should be. This follows the expectation generally agreed upon and accounted for by heterosis. But on these identically same animals the butter-fat percentage is decreased below the intermediate. This is not the expectation generally considered as due to heterosis although it is by no means impossible to assume that increased vigor may reduce rather than increase a character. The double nature of such a position does not appeal to the author, however, as furnishing more than a verbal explanation of the results having little parallel in the rest of genetics. The explanation which really seems most likely is that we have in these two cases the resultant of partially dominant factors. Numerous similar cases can be cited in genetics literature. Perhaps the best known case is that of *black* in Drosophila where the factor for this is normally classified as a recessive but where if occasion demands it may be used as a dominant; such a factor differs quite distinctly from another like *speck* which is consistently recessive. Such a parallel will explain the inheritance for butter-fat percentage by considering that the factors for low butter-fat percentage display more dominance in their expression than do the factors for high butter-fat percentage.

The inheritance of butter-fat percentage has occupied a prominent place in the discussions of breeding operations by practical dairymen. These men have held the following views as to the mode of this inheritance. The first has claimed that the tendency for high or low butter-fat percentage is transmitted by the sire to his offspring; the second that the dam transmits the tendency for high or low butter-fat percentage to the offspring; and the third that both parents contribute to the butter-fat percentage transmission. The results of these experiments show that the third of these claims is correct. Such being the case the dairyman who wishes his breeding operations to progress successfully will find it desirable to examine both sides of his animals' pedigrees carefully. Thus, today, the Jersey breeder pays a good deal more attention to the sires' side of the pedigree than he does the dams' side of the pedigree when in truth both sides are equally important.

MODE OF TRANSMISSION OF MILK QUANTITY AS SHOWN BY FIRST GENERATION CROSSES OF DAIRY AND BEEF BREEDS OF CATTLE.*

This paper is a further discussion of the results indicated in the abstracts on Inheritance of Milk Yield.

THE LIFE CYCLE OF APHIDS AND COCCIDS.*

To attempt to epitomize the life cycle of the aphid is like trying to draw an orderly sketch of Chaos. But after all, the confusion may be more seeming than real and certain rules, beset though they may be with exceptions, govern the life of even the aphid.

The gamogenetic egg is an outstanding argument for the conclusion that the aphid of the North is holding more closely to its prehistoric past than are those that spend their lives where the successive seasons of the year offer a constant source of food. For in the region of real winters there is no member of the family Aphididae (in its restricted sense) whose total life history has been worked out, that is known to pass its annual cycle without exhibiting a concluding generation comprising both sexes. The aphid, then, starts its life cycle like a typical insect—in the fertilized egg.

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*This is an abstract from a paper by John W. Gowen having the same title and published in Proceedings Soc. Promotion Agricultural Research.

*This is an abstract from a paper, having the same title, written by Edith M. Patch and published in Annals of the Entomological Society of America, Volume XIII, No. 2, pp. 156-167.

The overwintering egg is thus true to the traditions of the Hexapods, but with it ends all conventional observances, for between one such egg and the next in sequence there are crowded such phenomena as a succession of parthenogenetic viviparous generations; extreme examples of polymorphism; alternation of generations in a series where a duplication may not occur for seven or more generations; parallel series in which certain females give birth to true sexes without beaks while others of the same generation give rise to normal young which hibernate in the first instar without feeding; and a system of seasonal migration which is not surpassed by any other in the animal kingdom. That all these divergences from the ordinary life cycle for insects take place within the limits of the family Aphididae would seem remarkable indeed; but it is no less than appalling to realize that the total range of phenomena just indicated may be exhibited by a single species.

The eccentricities of the coccids are concerned with the specialization of their structural characters, and the modified metamorphosis of both sexes rather than with any striking range of habit or peculiarity in sequence of generations; since their typical life cycle comprises between one fertilized egg stage and the next but a single generation composed of both sexes. The extreme possibilities of coccid metamorphosis are illustrated by those species in which the females, at their first molt, lose, for good and all, eyes, antennae and legs. exhibiting in this atrophy of those organs of orientation and locomotion, a transformation which has to do with the loss of such organs as characterized them as insects in the first instar, rather than in the acquisition and development of the structures of an adult hexapod. This metamorphosis by reduction, associated with the complete absence of wing development in the female is correlated with the sedentary habit of this family and is in line with the atrophy of class structures in parasitic animals. But the suppression of generalized characters does not inhibit the appearance of special structures of a high degree of development, as is beautifully illustrated by the wax glands, marvelous in form and variety, to be found in the coccids; a concentration of structural effort directed toward the secretion of a waxy protection for these sedentary creatures and their eggs.

TRANSMISSION OF THE MOSAIC DISEASE OF IRISH POTATOES.*

This paper summarizes results of the continuation of experiments which were concerned with certain phases of potato mosaic, in particular transmission, and which were conducted mostly in northeastern Maine.

Transmission from season to season occurs in tubers produced by diseased plants. The parent plants may appear healthy throughout the season if infected late. Their diseased progeny show symptoms varying greatly in severity but averaging about the same for different lots and varieties. The severity of symptoms shown by obviously diseased parent plants is not changed much in their progeny. The percentage of disease in the progeny of apparently healthy parents can be reduced by selection of hills, tubers, or seed-pieces, but the reduction is too slight and uncertain to be of value.

The infectiousness of the disease was demonstrated by effecting transmission by means of tuber grafts, stem grafts, and inoculation with juice. This was done in part in the field with plant-lice eliminated, because previously reported experiments upon infectiousness had not been performed under such conditions and because plant-lice had been shown to be carriers of the disease. Juice inoculation was attempted from one variety to another and was successful.

Plant-lice, as had been found and reported previously, were a reliable means for transferring the disease. As more conditions favored the dispersal of these insects from diseased plots to healthy plants, there followed greater spread of the disease. One such favorable condition was growth in the open field in contrast to growth under insect cages in the field and in contrast to growth in a greenhouse with plant-lice controlled. Other favorable conditions were greater proximity to diseased plots, greater interseasonal abundance of plant-lice, and later dates of harvesting together with seasonal increase of plant-lice.

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*This is an abstract of a paper by Donald Folsom and a cooperating member of the Bureau of Plant Industry, having the same title and published in Journal of Agricultural Research, Vol. XIX, No. 7, p. 315-337.

Tests were made regarding the possibility of the existence of various means of transmission other than plant-lice. These tests indicated that among the various conceivable means of transmission plant-lice are distinguished from others by at least a much greater effectiveness and probably by being the only effective ones. The other means tested with negative results were soil, flea beetles, Colorado potato beetles, the seed-cutting knife, and contact of roots, stems, leaves, and seed-pieces.

It appears that the most important measures to be taken to prevent the spread of mosaic in a susceptible variety are those which will reduce or prevent dispersal of plant-lice from diseased to healthy plants.

METEOROLOGICAL OBSERVATIONS.

For many years the meteorological apparatus was located in the Experiment Station building and the observations were made by members of the Station Staff. June 1, 1911, the meteorological apparatus was removed to Wingate Hall and the observations are in charge of Dr. James S. Stevens, professor of physics in the University of Maine.

In September, 1914, the meteorological apparatus was moved to Aubert Hall, the present headquarters of the physics department.

The instruments used are at Lat. 44° 54′ 2″ N. Lon. 64° 40′ 5″ W. Elevation 135 feet.

The instruments used are the same as those used in preceding years, and include: Maximum and minimum thermometers; rain gauge; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of fifty-two years.

1920	January	February	March	April	May	June	July	August	September	October	November	December	Average	Total
Highest temperature	34	41	69	69	84	88	88	92	87	72	54	43		
Lowest temperature	—26	—29	— 9	21	5	39	44	44	30	28	2	— 9		
Mean temperature	10.81	17.35	31.45	39.6	50.6	61.6	66.3	66.95	54.1	50.1	30.65	23.05	41.88	
Mean temperature in 52 years	16.02	14.83	30.22	40.03	51.26	60.86	66.0	66.05	59.52	50.62	37.88	24.05	43.11	
Total precipitation in inches	2.55	7.75	2.92	4.48	1.53	2.16	3.36	2.19	5.71	2.37	2.68	2.81		40.51
Mean precipitation in 52 years	2.56	3.50	3.95	2.94	3.50	3.40	3.49	2.30	3.42	3.80	3.40	3.46		39.73
Number of days with precipitation of .01 or more	7	12	10	9	3	9	10	7	12	7	10	9		105
Snowfall in inches	25.5	77.5	13.5	.5							10.25	15.5		142.75
Mean snowfall in 52 years	21.8	22.3	14.88	5.78	.225					.725	5.94	16.46		
Number of clear days	17	15	19	10	17	15	15	20	14	16	9	9		176
Number of fair days	9	4	3	13	13	13	14	9	10	9	12	11		120
Number of cloudy days	5	10	9	7	1	2	2	2	6	6	9	11		70
Total movement of wind in miles	3041	3738	4973	4991	3572	3411	3447	2641	3200	3564	3606	3922		44106

REPORT OF THE TREASURER.

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts are audited by the State Auditor, and the Hatch Fund and Adams Fund accounts are also audited by the Office of Experiment Stations acting for the United States Secretary of Agriculture in accordance with Federal Law.

The income of the Station from public sources for the year that ended June 30, 1920, was:

U. S. Government, Hatch Fund appropriation	$15,000.00
U. S. Government, Adams Fund appropriation	15,000.00
State of Maine, Animal Husbandry investigation appropriation	5,000.00
State of Maine, Aroostook Farm investigation	5,000.00
State of Maine, Highmoor Farm investigations	5,000.00

The cost of maintaining the laboratories for the inspection analyses is borne by analysis fees and by the State Department of Agriculture. The income from sales at the experiment farms is used for the expense of investigations. The printing is paid for by an appropriation to the University.

At Aroostook Farm there are in connection with the cooperative work with the Federal Department of Agriculture expenditures mostly under "labor" for the Department and for which the Station is reimbursed. There are also certain expenditures for the Department made from sales of crops from Department investigations that do not appear in the tabular statements. They are carried as distinct and separate accounts, always with credit balances, on the Station ledger.

REPORT OF THE TREASURER FOR YEAR ENDING JUNE 30, 1920.

DISBURSEMENTS.

	Hatch Fund	Adams Fund	Animal Husbandry Investigations
Salaries	$8068.25	$9999.96	$4498.20
Labor	1042.75	2032.67	--------
Publications	195.04	--------	--------
Postage and Stationery	608.96	61.25	167.37
Freight and Express	148.11	116.28	12.00
Heat, light and power	598.29	289.18	--------
Chemical and laboratory supplies	4.12	23.58	49.46
Seeds, plants and sundry supplies	705.87	223.44	20.51
Fertilizers	830.89	--------	--------
Feeding stuffs	1912.09	1628.99	--------
Library	40.27	136.65	--------
Tools, machinery and appliances	125.87	--------	--------
Furniture and fixtures	204.82	121.75	--------
Scientific apparatus and specimens	46.19	26.96	.68
Live stock	--------	--------	--------
Traveling expenses	339.62	275.81	--------
Contingent expenses	--------	--------	251.78
Buildings	128.86	63.48	--------
Total	15000.00	15000.00	5000.00

REPORT OF THE TREASURER FOR YEAR ENDING JUNE 30, 1920.

DISBURSEMENTS.

	Aroostook Farm	Highmoor Farm	General Account	Inspection Analysis
Salaries	$1220.00	$1080.00	$1676.35	$11026.43
Labor	4915.23	2197.70	1888.06	--------
Publications	--------	--------	--------	--------
Postage and Stationery	71.05	73.95	78.83	385.07
Freight and Express	36.20	29.82	216.05	138.07
Heat, light and power	258.63	381.48	201.15	590.02
Chemical and laboratory supplies	--------	--------	--------	457.43
Seeds, plants and sundry supplies	1063.65	357.83	1761.96	39.71
Fertilizers	875.15	43.50	--------	--------
Feeding stuffs	1220.11	180.58	724.88	--------
Library	--------	--------	--------	--------
Tools, machinery and appliances	396.14	408.50	2186.07	--------
Furinture and fixtures	18.30	--------	--------	78.58
Scientific apparatus and specimens	--------	--------	25.25	183.92
Live stock	90.00	52.00	2300.00	--------
Traveling expenses	16.44	10.12	186.94	386.87
Contingent expenses	66.50	25.85	174.56	86.94
Buildings	214.71	158.67	--------	26.14
Total	$10,462.11	$5000.00	$11,420.10	$13,399.15

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